

CLAIMS

1. A process for the catalytic generation of hydrogen by the self-sustaining combination of partial oxidation and steam-reforming of a hydrocarbon comprising contacting a mixture of the hydrocarbon and an oxygen-containing gas and steam with a catalyst comprising rhodium dispersed on a refractory oxide support material which comprises as cations cerium and zirconium.

2. A process according to claim 1 wherein steam is introduced into the mixture of hydrocarbon and oxygen-containing gas after the self-sustaining partial oxidation of the hydrocarbon has commenced.

3. A process according to claim 1 or 2 wherein the hydrocarbon is a straight chain hydrocarbon or a branch chain hydrocarbon.

4. A process according to claim 3 wherein the hydrocarbon contains 1 to 15 carbon atoms.

5. A process according to claim 4 wherein the hydrocarbon contains 1 to 7 carbon atoms.

6. A process according to any one of the preceding claims wherein the hydrocarbon is selected from methane, propane, butane, hexane, heptane, normal-octane, iso-octane, naphthas, liquified petroleum gas, reformulated petrol and diesel-type fuels.

7. A process according to any one of the preceding claims wherein the oxygen-containing gas is air.

8. A process according to any one of the preceding claims wherein rhodium comprises 0.1 weight *per cent* to 5 weight *per cent* of the total weight of the supported catalyst.

9 A process according to claim 8 wherein rhodium comprises 0.2 weight *per cent* to 2.5 weight *per cent* of the total weight of the supported catalyst.

10. A process according to any one of the preceding claims wherein the refractory oxide support material is a mixture of ceria and zirconia.

11. A process according to claim 10 wherein the weight ratio of ceria to zirconia in the catalyst support material is from 0.5 to 99.5 to 99.5 to 0.5

12. A process according to claim 11 wherein the weight ratio of ceria to zirconia in the catalyst support material is from 5 to 95 to 95 to 5.

13. A process according to any one of the preceding claims wherein the catalyst is pre-heated to a temperature at which self-sustaining partial oxidation of the hydrocarbon commences.

14. A process according to claim 13 wherein the catalyst is pre-heated by direct heating to a temperature at which self-sustaining partial oxidation of the hydrocarbon commences.

15. A process according to claim 13 wherein the catalyst is pre-heated by catalytic heating to a temperature at which self-sustaining partial oxidation of the hydrocarbon commences.

16. A process according to claim 15 wherein the catalyst is pre-heated by feeding to the catalyst an oxygen-containing gas and an initiating compound which is more easily oxidisable than the hydrocarbon which is to be partially oxidised.

17. A process according to claim 16 wherein the initiating compound is selected from methanol, hydrogen and dimethyl ether.

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18. A process according to any one of the preceding claims wherein the mixture of hydrocarbon and oxygen-containing gas is fed to the catalyst when the catalyst has reached the temperature at which self-sustaining partial oxidation of the hydrocarbon will occur.

5 19. A process as claimed in any one of the preceding claims operated in combination with a catalysed water-gas shift reaction for the reduction of carbon monoxide in the hydrogen produced from the hydrocarbon.

10 20. A process as claimed in claim 19 wherein the catalyst for the water-gas shift reaction is a copper or iron based catalyst.

21. A process according to claim 19 or 20 wherein the water-gas shift reaction catalyst is added to the rhodium based catalyst for the hydrogen generation reaction.

15 22. The use in a fuel cell system of the process as claimed in any one of the claims 1 to 21 for the catalytic generation of hydrogen.

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